

REMARKS

Applicant concurrently files herewith a Petition and fee for a Three-month Extension of Time.

Claims 1-20 are all the claims presently pending in the application. Claims 1 and 3 have been amended and claims 4-20 have been added to more clearly define the invention.

It is noted that the claim amendments are made only for more particularly pointing out the invention, and not for distinguishing the invention over the prior art, narrowing the claims or for any statutory requirements of patentability. Further, Applicant specifically states that no amendment to any claim herein should be construed as a disclaimer of any interest in or right to an equivalent of any element or feature of the amended claim.

Claims 1-3 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Ham (U.S. Patent No. 6,466,291) in view of Song et al. (U.S. Patent No. 6,512,568) further in view of Shinjo et al. (U.S. Patent No. 5,495,352).

These rejections are respectfully traversed in the following discussion.

I. THE CLAIMED INVENTION

The claimed invention (e.g., as defined by claim 1) is directed to a liquid crystal display device which includes a first substrate on which a plurality of pixel electrodes are formed, a second substrate on which an opposing electrode is formed; and a liquid crystal layer sandwiched between the first and second substrates. Importantly, the second substrate may further include thereon a plurality of protrusions, each of the protrusions being positioned at a substantially central portion of a corresponding one of the pixel electrodes.

Conventional liquid crystal display devices attempt to improve a viewing angle by including a cutout portion of the common electrode and alignment layer (Application at Figure 1A; page 2, lines 15-16). When a voltage is applied, the electric fields at the edges of the cutout are tilted such that each pixel is divided into two or more liquid crystal domains. However, such conventional devices require additional processing steps and must be precisely positioned. (Application at page 3, lines 11-18).

The claimed invention, on the other hand, includes a plurality of protrusions, each of the protrusions being positioned at a substantially central portion of a corresponding one of the pixel electrodes (Application at page 12, lines 12-24; Figure 2A). The protrusions help to

define boundaries of multiple domains in the pixels (Application at page 16, lines 15-24). As a result, the claimed device has an improved viewing angle over conventional devices (Application at page 17, lines 4-9).

II. THE HAM, SONG AND SHINJO REFERENCES

The Examiner alleges that Ham would have been combined with Song, and the Ham/Song combination would have been further combined with Shinjo to form the claimed invention. Applicant submits, however, that these references would not have been combined and even if combined, the combination would not teach or suggest each and every element of the claimed invention.

Ham discloses an in-plane switching mode liquid crystal display device (LCD) in which a first portion of one pixel region has alignment direction clockwise inclined relative to the extension direction of the data electrode, and a second portion of the pixel region has alignment direction counterclockwise inclined relative to the extension direction of the data electrode (Ham at Abstract).

Song discloses a tetragonal ring shape aperture formed in the common electrode on one substrate, and a cross shape aperture formed at the position corresponding to the center of the tetragonal ring shape aperture in the pixel electrode on the other substrate. A liquid crystal layer between two electrodes are divided to four domains where the directors of the liquid crystal layer have different angles when a voltage is applied to the electrodes (Song at Abstract).

Shinjo discloses a liquid crystal display device including a pair of oppositely disposed substrates each having a plurality of opposing electrodes, and a ferroelectric liquid crystal disposed between the substrates so as to form a plurality of pixels each composed by a combination of a pair of the opposing electrodes and the ferroelectric liquid crystal disposed therebetween. Each pixel is provided with regions of different polarity inversion threshold voltages, and at least one of the pair of opposing electrodes is provided with a plurality of regions having unevennesses at different densities (Shinjo at Abstract).

However, Applicant submits that these references would not have been combined as alleged by the Examiner. Indeed, these references are directed to different problems and solutions. Specifically, Ham is intended to prevent a color shift in an LCD device (Ham at

col. 1, lines 59-61), and Song is intended to improve a viewing angle by forming apertures in field generating electrodes in the pixels (Song at col. 1, lines 65-67).

Shinjo, on the other hand, is unrelated to improving a viewing angle. Instead, Shinjo merely intends to improve a large number of gradation levels (Shinjo at col. 2, lines 51-54). Therefore, these references are completely unrelated, and no person of ordinary skill in the art would have considered combining these disparate references, absent impermissible hindsight.

Further, Applicant submits that the Examiner can point to no motivation or suggestion in the references to urge the combination as alleged by the Examiner. Indeed, the Examiner merely states that it would have been obvious to combine these references "in order to have a liquid crystal display device with better performance."

However, the references do not include such a suggestion as alleged by the Examiner. Therefore, Applicant respectfully submits that one of ordinary skill in the art would not have been so motivated to combine the references as alleged by the Examiner. Therefore, the Examiner has failed to make a prima facie case of obviousness.

Moreover, neither Ham, nor Song, nor Shinjo, nor any combination thereof teaches or suggests "*said second substrate further having thereon a plurality of protrusions, each of said protrusions being positioned at a substantially central portion of a corresponding one of said pixel electrodes*", as recited, for example, in claim 1.

As noted above, unlike conventional liquid crystal display devices which attempt to improve a viewing angle by including a cutout portion of the common electrode and alignment layer (Application at Figure 1A; page 2, lines 15-16), the claimed invention, includes a plurality of protrusions, each of the protrusions being positioned at a substantially central portion of a corresponding one of the pixel electrodes (Application at page 12, lines 12-24; Figure 2A). The protrusions help to define boundaries of multiple domains in the pixels (Application at page 16, lines 15-24). As a result, the claimed device has an improved viewing angle over conventional devices (Application at page 17, lines 4-9).

Clearly, these novel features are not taught or suggested by the cited references. Indeed, the Examiner completely fails to address this feature in the Office Action. In fact, there is no mention of this feature anywhere in the Office Action, and certainly not with respect to any of the cited references.

In fact, none of these references teach or suggest an LCD device having a plurality of protrusions, each of the protrusions being positioned at a substantially central portion of a corresponding one of the pixel electrodes. Indeed, Ham clearly fails to teach or suggest such protrusions. For example, Figure 4B illustrates a cross-section of a device according to Ham. As shown in Figure 4B, neither the first substrate 10, nor the second substrate 11 includes a protrusion formed thereon. In fact, nowhere does Ham teach or suggest such protrusions as defined in the claims of the present invention.

Song likewise fails to teach or suggest the protrusions of the claimed invention. Indeed, as noted above, the Song device attempts to utilize an apertures in field generating electrodes. This is completely unrelated to the claimed invention which includes protrusions formed on a substrate in the LCD device. In fact, nowhere does Song teach or suggest a protrusion formed on a substrate in the pixels of the device.

For example, Figure 10 in Song shows a cross section of the Song device. As shown in Figure 10, neither of the substrates 10, 20 include a protrusion formed thereon. Therefore, contrary to the Examiner's allegations, Song does not make up for the deficiencies of Ham.

Further, Shinjo clearly does not teach or suggest the features of the claimed invention. In fact, Shinjo is not even intended to improve a viewing angle of the LCD device, and is completely unrelated to the claimed invention.

Specifically, Shinjo may form "projections" (e.g., an "unevenness") on a transparent film electrode (Shinjo at col. 19, lines 31-34; Figure 25). Shinjo states that "by providing an unevenness pattern onto a transparent film electrode, it becomes possible to control the position of inversion domains and, by controlling the density of unevenness, it is possible to vary the voltage-transmittance characteristic" (Shinjo at col. 7, lines 31-35).

However, Shinjo forms dozens of these "projections" in each pixel 1 (e.g., see Shinjo at Figure 25). Moreover, these dozens of "projections" may be scattered all over the pixel. That is, the "projections" appear to be arbitrarily formed with respect to the pixel electrodes. Thus, the Shinjo device is completely unrelated to the claimed invention, in which the protrusions are positioned "at a substantially central portion of a corresponding one of said pixel electrodes".

Therefore, contrary to the Examiner's allegations, Shinjo would not make up for the deficiencies of any Ham/Song combination.

Therefore, Applicant submits that these references would not have been combined as alleged by the Examiner and even if combined, the combination would not teach or suggest each and every element of the claimed invention. Therefore, the Examiner is respectfully requested to withdraw this rejection.

III. FORMAL MATTERS AND CONCLUSION

In view of the foregoing, Applicant submits that claims 1-20, all the claims presently pending in the application, are patentably distinct over the prior art of record and are in condition for allowance. The Examiner is respectfully requested to pass the above application to issue at the earliest possible time.

Should the Examiner find the application to be other than in condition for allowance, the Examiner is requested to contact the undersigned at the local telephone number listed below to discuss any other changes deemed necessary in a telephonic or personal interview.

The Commissioner is hereby authorized to charge any deficiency in fees or to credit any overpayment in fees to Attorney's Deposit Account No. 50-0481.

Respectfully Submitted,

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